

What is claimed is:

1. A method of reprogramming a field device in a process control network having a plurality of devices which are communicatively linked on a bus and which use a standard communication protocol to perform process control functions, the method comprising the steps of:

4 downloading program instructions from a host device to one of the
6 field devices using the standard communication protocol;
8 storing the downloaded program instructions in the field device; and
causing the field device to execute the downloaded program instructions.

2. A method of reprogramming a field device in a process control network according to claim 1, wherein the downloading step comprises the step of transmitting the programming instructions from the host device to the one of the field devices using unscheduled queued communications.

3. A method of reprogramming a field device in a process control network according to claim 2, wherein the downloading step comprises the step of transmitting the programming instructions from the host device to the one of the field devices using a plurality of unscheduled queued communications.

4. A method of reprogramming a field device in a process control network according to claim 1, wherein the one of the field devices has a first memory with stored program instructions and a second memory, wherein said storing step comprises the step of storing the downloaded program instructions in the second memory while the one of the field devices is capable of executing the stored program instructions to perform process control.

666260" 82080460

Sub
C11
B1

5. A method of reprogramming a field device in a process control
 2 network according to claim 4, wherein the causing step comprises the step of copying
 the downloaded program instructions from the second memory to the first memory.

6. A method of reprogramming a field device in a process control
 2 network according to claim 4, wherein the causing step comprises the step of
 redirecting the one of the field devices from executing the stored program instructions
 4 in the first memory to executing the downloaded program instructions in the second
 memory.

7. A method of reprogramming a field device in a process control
 2 network according to claim 4, wherein the causing step comprises the steps of:
 ceasing the execution of the stored program instructions in the first
 4 memory;
 copying the downloaded program instructions from the second
 6 memory to the first memory;
 initiating the execution of the downloaded program instructions in the
 8 first memory.

8. A method of reprogramming a field device in a process control
 2 network according to claim 4, wherein the causing step comprises the steps of:
 ceasing the execution of the stored program instructions in the first
 4 memory;
 redirecting the field device to execute the downloaded program
 6 instructions in the second memory;
 initiating the execution of the downloaded program instructions in the
 8 second memory.

9. A method of reprogramming a field device in a process control network according to claim 1, wherein the standard communications protocol is the Fieldbus protocol.

10. A method of reprogramming a field device in a process control network according to claim 1, wherein the standard communications protocol is the HART protocol.

11. A system for reprogramming a field device in a process control network having a plurality of field devices communicatively linked over a bus, wherein each of the field devices is capable of communicating on the bus using a standard communications protocol during operation of the process control network, the system comprising:

a first device that generates downloadable program instructions and that transmits the downloadable program instructions over the bus using the standard communication protocol; and

a second device capable of receiving the downloadable program instructions transmitted over the bus, the second device comprising:

a processor adapted to execute a set of program instructions stored in the second device;

a first memory adapted to store a first set of program instructions that may be executed by the processor; and

a second memory adapted to store the downloadable program instructions transmitted over the bus;

wherein the first device transmits the downloadable program instructions to the second device and the second device receives the downloadable program instructions and stores the program instructions in the second memory during operation of the process control network.

12. A system for reprogramming a field device according to claim 11,
 2 wherein the standard communication protocol includes scheduled and unscheduled
 4 communications and the first device transmits the downloadable program instructions
 to the second device using unscheduled communications.

13. A system for reprogramming a field device according to claim 11,
 2 wherein the standard communication protocol includes concurrent analog and digital
 4 communications and the first device transmits the downloadable program instructions
 to the second device using digital communications.

14. A system for reprogramming a field device according to claim 11,
 2 wherein the first memory is a non-volatile memory and the second device stores the
 4 downloadable program instructions in the second memory while the processor is
 enabled to execute program instructions stored in the first memory to perform process
 control, and wherein the second device includes a transfer unit that disables the
 6 processor from executing program instructions stored in the first memory after the
 downloadable program instructions are stored in the second memory, that copies the
 8 downloadable program instructions from the second memory to the non-volatile
 memory of the first memory while the processor is disabled, and that reenables the
 10 processor to execute the downloadable program instructions stored in the first
 memory after the downloadable program instructions are copied.

15. A system for reprogramming a field devices according to claim 11,
 2 wherein the first memory is a non-volatile memory adapted to store the downloadable
 program instructions, the second memory is a non-volatile memory adapted to store
 4 program instructions that may be executed by the processor, the second device
 includes a transfer unit adapted to store information causing the processor to execute
 6 the program instructions stored in one of the first memory and the second memory,
 and wherein the transfer unit stores the downloadable program instructions in the
 8 other of the first memory and the second memory while the processor is enabled to

10 execute program instructions stored in the one of the first memory and the second
 12 memory to perform process control, disables the processor from executing program
 14 instructions stored in the one of the first memory and the second memory after the
 16 downloadable program instructions are stored in the other of the first memory and the
 second memory, updates the stored information to cause the processor to execute the
 downloadable program instructions stored in the other of the first memory and the
 second memory while the processor is disabled, and reenables the processor to
 execute the downloadable program instructions stored in the other of the first memory
 and the second memory.

2 16. A system for reprogramming a field devices according to claim 11,
 4 wherein the second device further comprises a non-volatile memory having a first
 6 portion containing the first memory, a second portion containing the second memory,
 8 the first memory and the second memory being adapted to store program instructions
 10 that may be executed by the processor and downloadable program instructions
 12 received in the input signal, and a transfer unit having a third memory adapted to store
 14 information causing the processor to execute the program instructions stored in one of
 16 the first memory and the second memory, and wherein the transfer unit stores the
 18 downloadable program instructions in the other of the first memory and the second
 memory while the processor is enabled to execute program instructions stored in the
 one of the first memory and the second memory to perform process control, disables
 the processor from executing program instructions stored in the one of the first
 memory and the second memory after the downloadable program instructions are
 stored in the other of the first memory and the second memory, updates the stored
 information in the third memory to cause the processor to execute the downloadable
 program instructions stored in the other of the first memory and the second memory
 while the processor is disabled, and reenables the processor to execute the
 downloadable program instructions stored in the other of the first memory and the
 second memory after the third memory is updated.

17. A reprogrammable field device capable of being used in a process control network having a plurality of devices communicatively coupled to a bus, wherein each of the devices is capable of communicating on the bus using a standard communications protocol, and wherein a host device is capable of generating input signals including downloadable program instructions and transmitting the input signals to the reprogrammable field device over the bus during operation of the process control network, the reprogrammable field device comprising:

a processor adapted to execute a set of program instructions stored in the reprogrammable field device;

a first memory adapted to store a first set of program instructions that may be executed by the processor; and

a second memory adapted to store the downloadable program instructions transmitted over the bus;

wherein the reprogrammable field device receives the downloadable program instructions and stores the downloadable program instructions in the second memory during operation of the process control network.

18. A reprogrammable field device according to claim 17, wherein the standard communication protocol includes scheduled and unscheduled communications and the host device transmits the downloadable program instructions to the reprogrammable field device using unscheduled communications.

19. A reprogrammable field device according to claim 17, wherein the standard communication protocol includes concurrent analog and digital communications and the host device transmits the downloadable program instructions to the reprogrammable field device using digital communications.

20. A reprogrammable field device according to claim 17, wherein the first
2 memory is a non-volatile memory and the reprogrammable field device stores the
downloadable program instructions in the second memory while the processor is
4 enabled to execute program instructions stored in the first memory to perform process
control, and wherein the reprogrammable field device further comprises a transfer
6 unit that disables the processor from executing program instructions stored in the first
memory after the downloadable program instructions are stored in the second
8 memory, copies the downloadable program instructions from the second memory to
the non-volatile memory of the first memory while the processor is disabled, and
10 reenables the processor to execute the downloadable program instructions stored in
the first memory after the downloadable program instructions are copied.

21. A reprogrammable field device according to claim 17, wherein the first
memory is a non-volatile memory adapted to store the downloadable program
instructions received in the input signals, the second memory is a non-volatile
4 memory adapted to store program instructions that may be executed by the processor,
and the reprogrammable field device further comprises a transfer unit having a third
6 memory adapted to store information causing the processor to execute the program
instructions stored in one of the first memory and the second memory, and wherein
8 the transfer unit stores the downloadable program instructions in the other of the first
memory and the second memory while the processor is enabled to execute program
10 instructions stored in the one of the first memory and the second memory to perform
process control, disables the processor from executing program instructions stored in
12 the one of the first memory and the second memory after the downloadable program
instructions are stored in the other of the first memory and the second memory,
14 updates the stored information in the third memory to cause the processor to execute
the downloadable program instructions stored in the other of the first memory and the
16 second memory while the processor is disabled, and reenables the processor to
execute the downloadable program instructions stored in the other of the first memory
18 and the second memory after the third memory is updated.

22. A reprogrammable field device according to claim 17, further comprising:

a non-volatile memory having a first portion containing the first memory and a second portion containing the second memory, the first memory and the second memory being adapted to store program instructions that may be executed by the processor and downloadable program instructions received in the input signal; and

a transfer unit adapted to store information causing the processor to execute the program instructions stored in one of the first memory and the second memory,

wherein the transfer unit stores the downloadable program instructions in the other of the first memory and the second memory while the processor is enabled to execute program instructions stored in the one of the first memory and the second memory to perform process control, disables the processor from executing program instructions stored in the one of the first memory and the second memory after the downloadable program instructions are stored in the other of the first memory and the second memory, updates the stored information to cause the processor to execute the downloadable program instructions stored in the other of the first memory and the second memory while the processor is disabled, and reenables the processor to execute the downloadable program instructions stored in the other of the first memory and the second memory after the third memory is updated.

23. A method of reprogramming a field device in a process control network having a plurality of devices which are communicatively linked on a bus to perform process control functions, the method comprising the steps of:

downloading program instructions from a host device to one of the field devices wherein the host device divides the program instructions into a

plurality of data packets that are downloaded to the one of the field devices
over time;

reassembling the downloaded data packets into the program
instructions in the field device;

storing the downloaded program instructions in the field device; and
causing the field device to execute the downloaded program

instructions.

24. A method of reprogramming a field device in a process control
network according to claim 23, wherein the downloading step comprises the step of
transmitting the data packets from the host device to the one of the field devices using
a plurality of unscheduled queued communications.

25. A method of reprogramming a field device in a process control
network according to claim 23, wherein the one of the field devices has a first
memory with stored program instructions and a second memory, wherein said storing
step comprises the step of storing the downloaded program instructions in the second
memory while the one of the field devices is capable of executing the stored program
instructions to perform process control.

26. A method of reprogramming a field device in a process control
network according to claim 25, wherein the causing step comprises the step of
copying the downloaded program instructions from the second memory to the first
memory.

27. A method of reprogramming a field device in a process control
network according to claim 25, wherein the causing step comprises the step of
redirecting the one of the field devices from executing the stored program instructions
in the first memory to executing the downloaded program instructions in the second
memory.

28. A method of reprogramming a field device in a process control network according to claim 25, wherein the causing step comprises the steps of:

ceasing the execution of the stored program instructions in the first memory;

copying the downloaded program instructions from the second memory to the first memory;

initiating the execution of the downloaded program instructions in the first memory.

29. A method of reprogramming a field device in a process control network according to claim 25, wherein the causing step comprises the steps of:

ceasing the execution of the stored program instructions in the first memory;

redirecting the field device to execute the downloaded program instructions in the second memory;

initiating the execution of the downloaded program instructions in the second memory.

30. A method of reprogramming a field device in a process control network according to claim 23, wherein the plurality of devices communicate using a standard communication protocol.

31. A system for reprogramming a field device in a process control network having a plurality of field devices communicatively linked over a bus, wherein each of the field devices is capable of communicating on the bus during operation of the process control network, the system comprising:

a first device that divides downloadable program instructions into a plurality of data packets and that transmits the data packets over the bus; and

a second device capable of receiving the data packets transmitted over the bus and reassembling the data packets into the downloadable program instructions, the second device comprising:

a processor adapted to execute a set of program instructions stored in the second device;

a first memory adapted to store a first set of program instructions that may be executed by the processor; and

a second memory adapted to store the downloadable program instructions transmitted over the bus;

wherein the first device transmits the data packets to the second device and the second device receives the data packets, reassembles the data packets into the downloadable program instructions, and stores the program instructions in the second memory during operation of the process control network.

32. A system for reprogramming a field device according to claim 31, wherein the field devices communicate using scheduled and unscheduled communications and the first device transmits the data packets to the second device using unscheduled communications.

33. A system for reprogramming a field device according to claim 31, wherein the field devices communicate using concurrent analog and digital communications and the first device transmits the data packets to the second device using digital communications.

34. A system for reprogramming a field device according to claim 31, wherein the first memory is a non-volatile memory and the second device stores the downloadable program instructions in the second memory while the processor is enabled to execute program instructions stored in the first memory to perform process control, and wherein the second device includes a transfer unit that disables the

6 processor from executing program instructions stored in the first memory after the
downloadable program instructions are stored in the second memory, that copies the
8 downloadable program instructions from the second memory to the non-volatile
memory of the first memory while the processor is disabled, and that reenables the
10 processor to execute the downloadable program instructions stored in the first
memory after the downloadable program instructions are copied.

35. A system for reprogramming a field devices according to claim 31,
2 wherein the first memory is a non-volatile memory adapted to store the downloadable
program instructions, the second memory is a non-volatile memory adapted to store
4 program instructions that may be executed by the processor, the second device
includes a transfer unit adapted to store information causing the processor to execute
6 the program instructions stored in one of the first memory and the second memory,
and wherein the transfer unit stores the downloadable program instructions in the
8 other of the first memory and the second memory while the processor is enabled to
execute program instructions stored in the one of the first memory and the second
10 memory to perform process control, disables the processor from executing program
instructions stored in the one of the first memory and the second memory after the
12 downloadable program instructions are stored in the other of the first memory and the
second memory, updates the stored information to cause the processor to execute the
14 downloadable program instructions stored in the other of the first memory and the
second memory while the processor is disabled, and reenables the processor to
16 execute the downloadable program instructions stored in the other of the first memory
and the second memory.

36. A system for reprogramming a field devices according to claim 31,
2 wherein the second device further comprises a non-volatile memory having a first
portion containing the first memory, a second portion containing the second memory,
4 the first memory and the second memory being adapted to store program instructions
that may be executed by the processor and downloadable program instructions

6 received in the input signal, and a transfer unit having a third memory adapted to store
information causing the processor to execute the program instructions stored in one of
8 the first memory and the second memory, and wherein the transfer unit stores the
downloadable program instructions in the other of the first memory and the second
10 memory while the processor is enabled to execute program instructions stored in the
one of the first memory and the second memory to perform process control, disables
12 the processor from executing program instructions stored in the one of the first
memory and the second memory after the downloadable program instructions are
14 stored in the other of the first memory and the second memory, updates the stored
information in the third memory to cause the processor to execute the downloadable
16 program instructions stored in the other of the first memory and the second memory
while the processor is disabled, and reenables the processor to execute the
18 downloadable program instructions stored in the other of the first memory and the
second memory after the third memory is updated.

ab
cont

00408028-092999